Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.8, No.10, 2018

Households' Coping Dynamics to Climatic Shocks of Flood and Drought in Northern Ghana

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Abstract

The Guinea and Sudan Savannah zones of Ghana experiences much of the recent climate change effects than any other ecological zone in the country. This paper presents the coping strategies adopted by households in response to the climate change effects of floods and droughts in Northern Ghana. The study espoused a case study design. Key informants' interviews, focus group discussions and household interviews were the methods applied in gathering primary data from 250 household heads randomly selected from six farming communities along the white Volta basin within three disaster prone districts. The descriptive statistic tool of SPSS was employed in analyzing, summarizing and describing the data obtained. Key subjective views of the participants were also presented using quotations. Destruction of food crops and livestock, decline in crop yield and food shortage as well as destruction of building were identified by the study as the most devastating effects of floods and droughts in the study areas. To cope with these effects, households adopted various coping dynamics which included decision not to farm or build in lowlands areas or waterways, migration, reliance on external support and early planning of activities. The study concludes that the effects of both floods and drought in Northern Ghana poses great challenges to livelihoods of households who have adapted by find coping strategies. The findings reveal new dimensions of the empirical accounts on households' coping dynamics in response the climatic effects of flood and drought.

Keywords: Floods; droughts; climate change; coping strategies; rural household

1. Introduction

Poverty is still endemic in developing countries despite decades of receiving aid from development partners to alleviate poverty. Increased agricultural productivity plays a vital role in economic development and poverty reduction (Hasnip,1999; Irz and Roe, 2000). Dixon et al., (2001) are of the view that 90% of the poverty in Sub-Saharan Africa is classified as rural poverty and about 80% of the poor still rely on agricultural activities for their livelihoods. The World Bank (2000) has also revealed that in Sub-Sahara Africa, agriculture alone contributes 35% of Gross Domestic Product (GDP) and more than 70% of the population have their livelihood activities around agriculture. According to Nelson et al. (2009), nearly 2.5 billion of the population still rely on agriculture for their livelihood.

Okudzeto et al. (2014) has indicated that in Ghana, the agricultural sector alone accounts for 20% of the nation's GDP and more than 40% of the population still have their livelihoods around agricultural activities. This notwithstanding, agriculture in Ghana has been declining in terms of its percentage contribution to the nation's GDP over the years. In 2012 for instance, Okudzeto et al., (2014) are of the view that crop production alone accounted for almost 16.4% of the GDP as compared to 19% in 2008.

There are so many factors that are causing the decline of crops yield and the decreasing growth of the agricultural sector in Sub-Sahara Africa. Among these factors include low rainfall and high temperatures experienced by the region (IPCC 2001; Jones and Thornton, 2003). The agricultural sector is one of the main sectors that is vulnerable to climate change and climate variability thus resulting in insufficient crop production which in turn to lead to food insecurity. According to the Intergovernmental Panel on Climate Change (IPCC) (2007), agriculture is highly vulnerable to natural shocks such as hurricanes, droughts, floods, and rising sea levels among others. Evaluating the climate factors that affect agriculture production shows that rainfall and temperature are the main two variables that have much impact on crop yield (Deschenes and Greenstone, 2007).

Location is an important factor in determining the impact of climate change. For example, higher temperatures are able to help the agricultural sector in Europe whilst in Africa, higher temperatures have adverse effects on the agricultural sector particularly for cereal crops (Tol et al., 2000; McCarthy 2001). According to IPCC (2007), temperatures rising above 3ºC is expected to have negative implications on crop production in all regions. In addition to the effects of climate change, FAO (2008) revealed that livestock products, as well as meat supply, will be influenced by crop production trends since feed crops account for roughly 25 percent of the world's cropland. Climate change will likely reduce the length of the growing season as well as force large areas of marginal agricultural potential out of production resulting in food insecurity.

Information from the Ghana Environmental Protection Agency shows that the Sahara Desert is advancing southwards by an estimation of 0.8 kilometers every year (Dururugu, 2010). This has a number of implications for Northen Ghana since it is only some miles away. Among such consequent effects are the low crop yields, unemployment and migration of people in the Northern region to the South. Marchetta (2011) indicated that high rainfall pattern has increased the frequency and severity of floods in Northern Ghana over the last two decades. For instance, the region experienced heavy rainfalls which resulted into two major floods between August and September in the years 2007 and 2009 (Armah et al., 2010). This resulted in destroying farms and physical capital.

It is also clear that rainy season in the North now begins later in the year prolonging drought periods and also affecting the variability of the rainfall pattern resulting in the reduction of crop yield and loss of livestock due to water shortage (Dietz et al, 2006, Hasselberg & Yaro, 2006). The weather pattern of Northern Ghana always has a period of drought which is usually considered a "normal" condition though the severity and length of the drought period differ yearly. It is assumed that households in this area have already adapted to such recurring events. All these issues have gone a long way to affect food security and the livelihoods of people in the Northern region since basically their livelihoods are around agriculture and activities surrounding agriculture. The three regions of the North, comprising Northern region, Upper East region and Upper West region are considered the poorest areas in Ghana and among the most degraded environments in the country (GSS, 2014, 2008; Ziem, 2012). Similarly, these regions are also the most vulnerable to the effects of climate change due to many negative environmental practices being perpetuated by the people over the years for economic gains" (Ziem, 2012).

The low precipitation levels and high temperatures experienced recently by the regions coupled with high illiteracy rate, small-scale farming, poor infrastructure, high poverty level and limited access to information are the main reasons, the three northern regions are subjected to climate change vulnerability. Information available indicates that temperatures in the Northern part of Ghana are rising more quickly than that of the South. Data from the Ghana Meteorology Agency have showed that there is a rise of 1oC temperature and a reduction of 20% of rainfall in the whole of Ghana from 1961 to 2000 (EPA, 2008). The rising temperature in the North are more pronounced than that in the South. The low rainfall experienced in the North is also seasonal as compared to the South. The variability of rainfall, as well as the timing of rains, has an effect on agriculture activities (Yengoh et al., 2010). The IPCC model has projected that a volume of 80mm rainfall is feasible to reduce monthly during the farming season of June to August every year in the Northern region of Ghana (Christensen et al., 2007 cited in Antwi-Agyei, 2012). The variability of rain in Northern Ghana over the years has changed the planting time from early April to late April or early May (Mensah-Bonsu, 2003).

Reactive measures have been used over the years to cope with these climatic extreme events such as floods which are typical of the region. There are additional coping measures that require the intervention of government and other non- governmental organizations. Nonetheless, the underlining fact remains that these measures only reduce the severity of the impact of climate variability and do not or cannot eliminate it completely (Nti, 2012). A good understanding of the vulnerability and coping strategies of households in farming communities to climate effects in the Northern region is and, therefore, paramount to enhance policy decisions towards tackling the challenges that climate change poses to farming communities and hence the basis for this research.

2. Conceptualizing Climate Change and Livelihood: A Theoretical Review

2.1 Climate and Agro-ecological zones of Northern Ghana

In Ghana, rainfall quantities normally decrease from the southern part of the country to the northern part of the country, averagely ranging between 800mm to 2200mm per annum (UNFAO, 2005). There are six different ecological zones in Ghana namely Transition, Deciduous forest, Coastal savannah, Rainforest, Guinea savannah and Sudan savannah. These zones each have distinct annual mean rainfall and number of raining days (Table 1). The Northern part of Ghana falls under Guinea savannah and Sudan savannah zones and has one rainy season (i.e. from May to September) whilst the other four agro-ecological zones are characterized by two main rainy seasons namely major rainy season (i.e. from March to July) and minor rainy season (i.e. from September to October/November).

Table 1: Climate distribution by agro-ecological zones

Zone	Area (in thousand ha)	Percent of total area	Mean annual rain (mm)	Growing period (days)	
				Major season	Minor season
Guinea Savannah	14,790	63	1,100	180-200	-
Rain Forest	750	3	2,200	150-160	100
Sudan Savannah	190	1	1,000	150-160	-
Coastal Savannah	580	2	800	100-110	60
Transition	6,630	28	1,300	200-220	60
Deciduous Forest	740	3	1,500	150-160	90

Source: SRID, 2001.

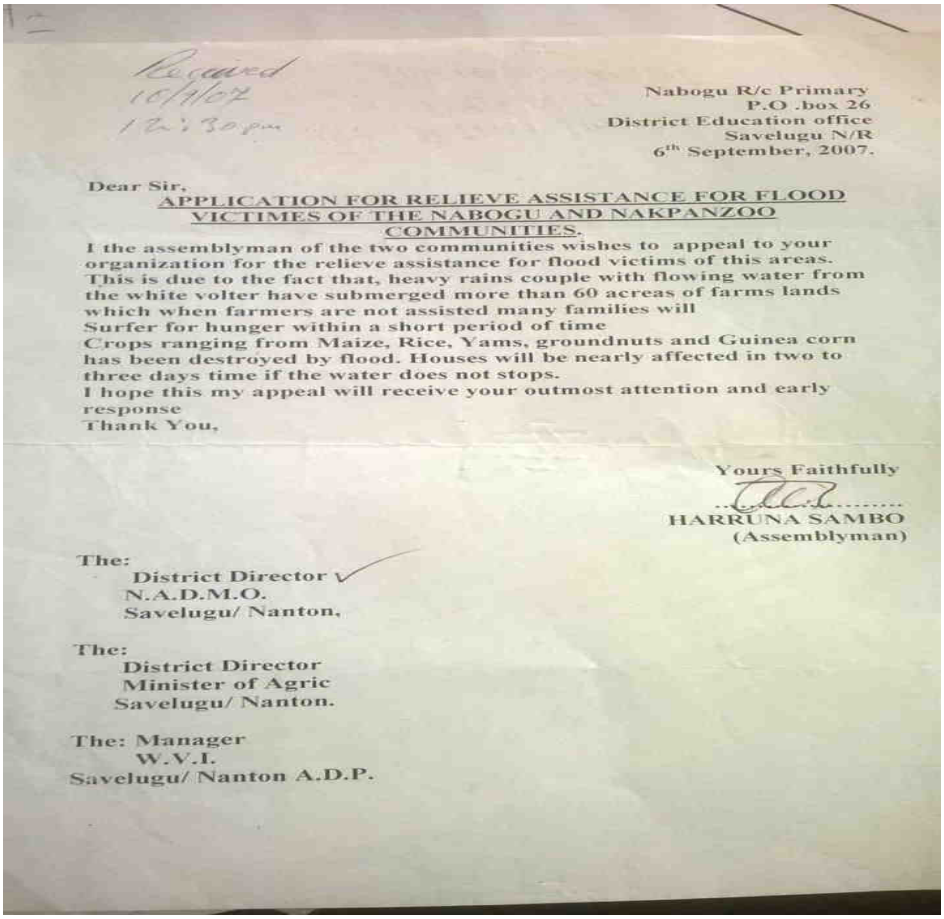
2.2 The Concepts of Flood and Drought

There are two main key concepts when talking about climate change in the Northern part of Ghana, namely drought and flood. Floods and droughts have become a developmental issue due to their effects on rural farming communities, making the rural farmers not to be able to contribute their quota to the growth of the economy of the country. Funds meant for developmental projects are channeled to floods and droughts disaster victims in a form of relief items and the reconstruction of drains for easy passage of floods water.

Droughts are one of the most occurring threats in the Northern region of Ghana and a major threat to rural livelihood. Droughts are natural hazards which cause damage to livelihoods in a slow space (Wilhite et al., 2000). Droughts occur when there are no rains for a longer period of time in a particular region or zone. The phenomenon is common in the Northern part of Ghana than in the Southern part of the country. This is as a result of the Sahara Desert moving southwards by about 0.8km (Dururugu, 2010). Any time there is a drought in the North, crops and livestock production gets affected, rivers and irrigation dams also get dry up thus affecting dry season farming as well as electricity supply from the Akosombo dam which has its tributary from the North and Burkina Faso. In the Kumbungu District (i.e. one of the study districts), forty-one (41) households, one hundred and seventy-two (172) people and forty-two (42) acres of cultivated land were destroyed by drought in the year 2012 according to the District Coordinator of National Disaster Management Organization (NADMO).

On the other hand, floods are another common climatic condition in the country as well as in the study area. This is always as a result of heavy and continuous downpour or the opening of the Bangre dam in Burkina Faso which leads to the flooding of communities along the Volta basin. Floods in Northern Ghana normally occur between July and September when the rains are at their peak or the intensity of the rain is high. Floods destroyed properties and lives and, in some instances, social nets were broken.

According to the Municipal NADMO Coordinator for Savelugu-Nanon Municipality, in 2007 which is one of the years that recorded higher number of flood cases in Northern region of Ghana indicates that in Nabogo which is one of the study communities, ninety-six (96) households were affected, one thousand one hundred and eighty (1180) people affected, one hundred and forty-eight (148) rooms affected and three hundred and eight (308) acres of maize affected. A letter intercepted (Figure 1) in the office of NADMO municipal coordinator which was written by Nabogo assemblyman indicates sixty (60) acres of cultivated maize, yam, rice, groundnut and guinea corn were destroyed by the 2007 floods.



Received
10/11/07
12:30pm

Nabogu R/c Primary
P.O .box 26
District Education office
Savelugu N/R
6th September, 2007.

Dear Sir,

APPLICATION FOR RELIEVE ASSISTANCE FOR FLOOD VICTIMES OF THE NABOGU AND NAKPANZOO COMMUNITIES.

I the assemblyman of the two communities wishes to appeal to your organization for the relieve assistance for flood victims of this areas. This is due to the fact that, heavy rains couple with flowing water from the white volter have submerged more than 60 acreas of farms lands which when farmers are not assisted many families will
Surfer for hunger within a short period of time
Crops ranging from Maize, Rice, Yams, groundnuts and Guinea corn has been destroyed by flood. Houses will be nearly affected in two to three days time if the water does not stops.
I hope this my appeal will receive your outmost attention and early response
Thank You,

Yours Faithfully
.....
HARRUNA SAMBO
(Assemblyman)

The:
District Director
N.A.D.M.O.
Savelugu/ Nanton,

The:
District Director
Minister of Agric
Savelugu/ Nanton.

The: Manager
W.V.I.
Savelugu/ Nanton A.D.P.

Figure: 1 Flood disaster response letter.

Source: NADMO office

Again, according to the municipal NADMO coordinator in the same year, Kuldanali (i.e. also one of the study communities), three hundred and forty-four (344) people were affected and one hundred (100) acres of maize farm were destroyed by the floods. A letter (Figure 2) from the chief of Kuldanali was also intercepted in the office of the Municipal coordinator of NADMO shows that two hundred and fifty (250) acres of cultivated land were destroyed by the floods.

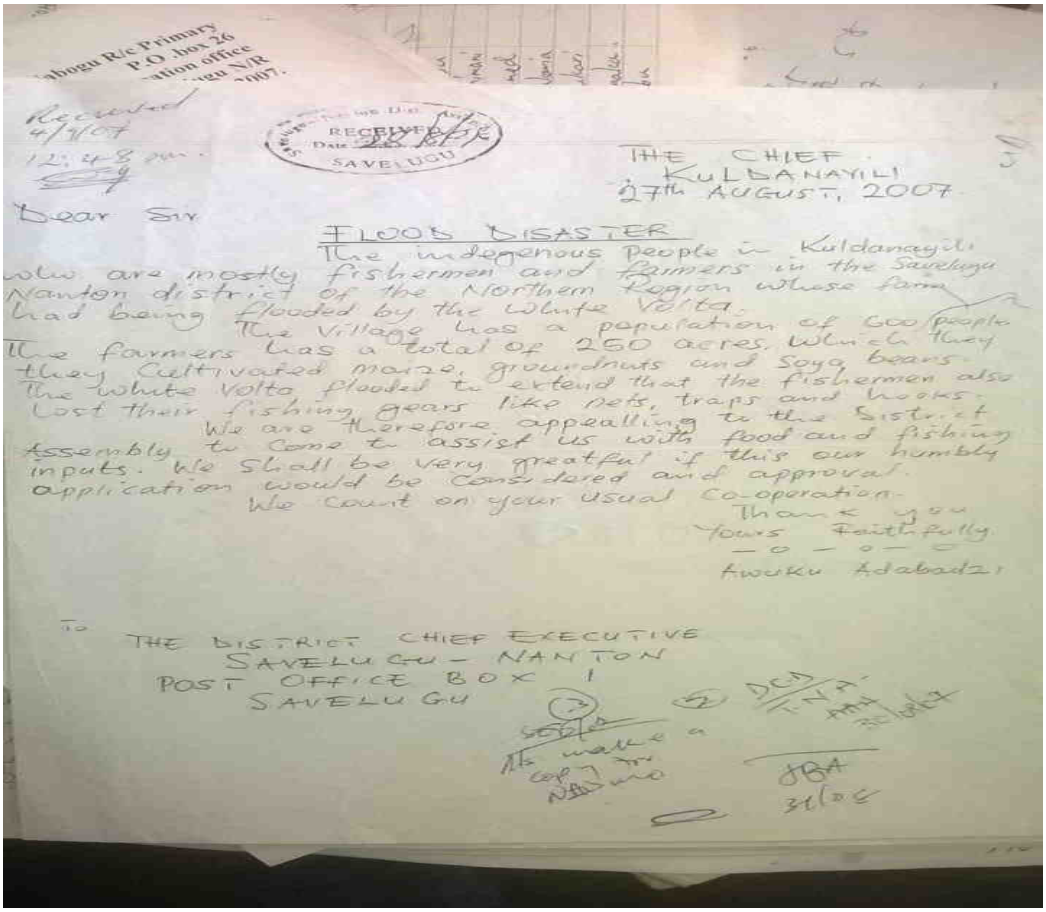


Figure 2: Flood disaster response letter

Source: NADMO office

2.3 Climatic Shocks and Livelihoods of farming communities

"A livelihood comprises the capabilities, assets, and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its Capabilities and assets both now and in the future, while not undermining the natural resource base" (DFID, 1999a). Marchetta (2011) indicates that such definition is seen as a relevant theoretical framework for the analysis of sustainable rural livelihood context. In otherwise households becomes vulnerable to natural shocks and stresses such as floods and droughts when these capabilities, assets, and activities required by local farmers to undertake a range of livelihood activities are being affected or destroyed by climate change.

2.4 The Vulnerability Context

How well a household can draw on its assets to pursue its diverse livelihood activities depends on its vulnerability context (Woller et al., 2013). A vulnerability is defined as: "the extent to which climate change may damage or harm a system," depending "not only on a system's sensitivity but also on its ability to adapt to new climatic conditions" (Watson et al., 1998). A vulnerability is a day-to-day reality for many households. The household's vulnerability context is influenced by factors both outside of and within its control. Those outside its control includes stresses and shocks. Stresses are long-term trends or recurring events that put ongoing pressure on the household's livelihood and food security. In contrast, shocks are unanticipated adverse events that undermine the household's livelihood and food security (Woller et al., 2013). Stresses and shocks emanate from a variety of sources in the economic, natural, health, political, and social environments. In this study, much is concentrating on natural shocks and stresses.

3. Methods

The study adopted the case study design in answering the research questions for the study. Data were collected

from two main sources namely primary and secondary. Personal observation, semi-structured interview, key informants interview and focus group discussions were employed to gather primary data. This was complemented by peer reviewed journal articles, books and institutional data. The study adopted a multi-stage sampling technique. Firstly, the purposive sampling technique was used to select four Districts among a group of districts that are prone to natural shocks and stresses. The four districts selected were the most prone to natural shocks and stresses. Six communities, all along the White Volta basin or lake were then selected from the four districts using simple random sampling technique. The communities selected included Nabogo, Kudalnali, Makango, Kafaba, Nawuni, and Afayili. The households from the various study communities were randomly sampled.

Household heads in the study communities in Northern region constituted the main population for the study. The field work was based on a household survey; hence, the number of households made up the main sampling frame from which various sampling units were selected for investigation (Table 2). Some officials of MOFA and NADMO also formed part of the sample unit.

Table 2: List of selected Districts, study communities, population and number of Households

District	Study community	Population	Number of households
East Gonja	Makango	3,052	464
	Kafaba	1,814	252
Savelugu/Nanton	Kuldanali	407	70
	Nabogo	1,677	202
Kumbungu	Nawuni	960	106
	Afayili	182	23
Total		8,092	1,117

Source: Field Survey, (2015)

The study employed a statistical formula to determine the sample size (n) from a sample frame of 1,117 households, with 5% margin of error and confidence level of 95%. Based on that, the statistical sampling model was applied as follow: $n = N \div [1 + N (\alpha) 2]$, where n= the sample size, N= the sample frame (1,117), α= margin of error which is 0.05 with a confidence level of 95%. Substituting the above-given information into the model results into the following as the sample size for the study. n= 464+252+202+70+106+23/1+1117 (0.05)2 = 1117/3.79 = 294.

A total of two hundred and fifty (250) households instead of 294 were surveyed due to the inability on the part of the researchers to reach all the household members during the study time line and also the unwillingness of some households to participate in the study despite several attempts to get them to be part of the study. The sample size of two hundred and fifty (250) as used in relation to the number of households in the six study communities is shown in Table 3. The descriptive statistic tool of SPSS was employed in analysing the quantitative data obtained which are presented in the form of pie charts, frequecy tables and bar graphs. In addition, key subjective views of the participants were presented using quotations.

Table 3: List of clusters, communities, and number of sampled households surveyed

Clusters	Communities	Number of households	Surveyed households	Focus Group Discussion	Key informant Interview
East Gonja	Makango	464	104	1	2
	Kafaba	252	56	1	
Savelugu/Nanton	Nabogo	202	45	1	2
	Kuldanali	70	16	1	
Tolon/Kumbungu	Nawuni	106	24	1	2
	Afayili	23	5	1	
Total		1117	250	6	6

Source: Field Survey, (2015)

4. Results and Discussion

4.1 Occupation and Land Holdings of household heads

Majority (85.2%) of the household heads sampled for the study were engaged in farming which entails crops, livestock and fish farming. In addition, 13.2% of the remaining household heads were traders with a minority of 1.6% engaged in other occupations aside farming and trading. This variation affirms the fact that agriculture remains the dominant economic activity in the region and the study area as well and it is in consistent with Ghana Statistical Service (2010) findings. The size of farm land owned by household is an important asset in rural communities of Ghana. Studies show that land size had both negative and positive effects on adoption (Bradshaw et al., 2004). The findings indicated majority (93%) of the total households surveyed owns land whilst the remaining 7% (minority) does not own a land (Table 4). The size of land cultivated by a household ranges from 0.5 to 16 acres and above with the average land holding of 2.1 acres.

Table 4: Asset characteristics of households (Land holding)

Size of land owned	Frequency	Percent
0.5-5 Acres	82	32.8
6-10 Acres	71	28.4
11-15 Acres	47	18.8
16 Acres Above	32	12.8
No Response	18	7.2
Total	250	100.0

Source: Field Survey, 2015 n=232 mean= 2.1 SD= 1.0

4.2 Effects of floods and drought on household

Floods and droughts are the most common climate factors affecting the lives and livelihoods of rural folks in the Northern part of Ghana. The effects of flood vary from declining of crop yield to the destruction of crops, livestock and houses.

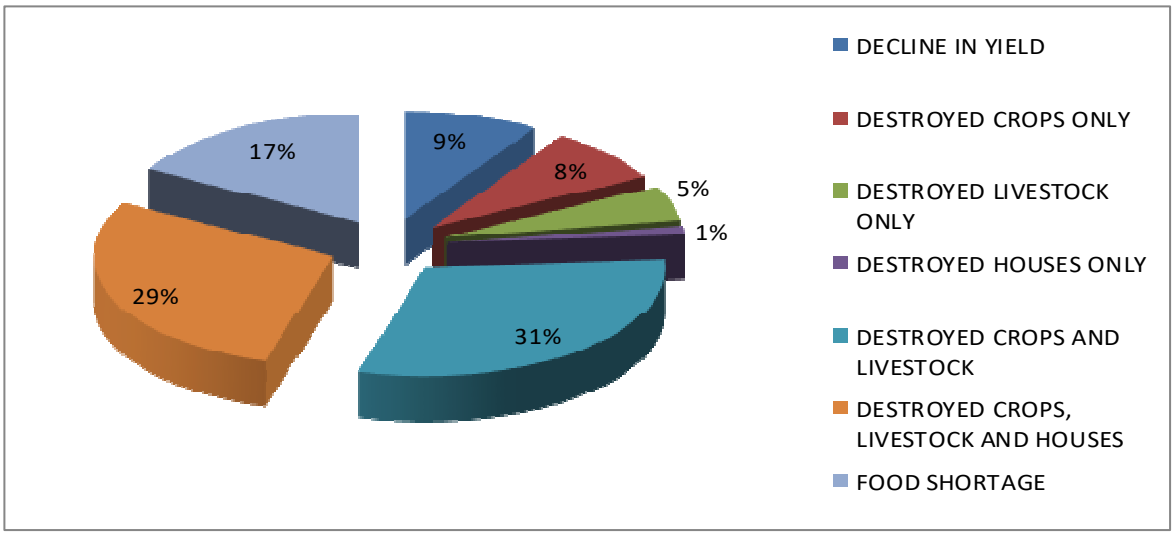


Figure 3: Effects of Floods on Households

Source: Field Survey, 2015

As shown from Figure 3, the study revealed that majority (31%) of the respondents attributed floods effects to the destruction of both crops and livestock whiles 29% of the remaining respondents attributed the effects of floods to a triple impact, destruction of crops, livestock and houses. Again 17% of the remaining respondents attributed effects of floods to the shortage of food. Furthermore, 9% and 8% of the respondents attributed the effects of floods to decline of crops yield and destruction of crops only respectively. In addition, 5% and 1% (i.e. minority) of the respondents attributed the effects of floods to the destruction of livestock only and destruction of houses only respectively. Due to these effects, members of a household are always made to migrate to different place in search of shelter and job. In Kafaba in the East Gonja district one respondent (39) intimated as follows:

"at one instance, our homes were flooded, and we moved from our homes to a camp for temporal shelter. This resulted in my household's members scattering in all the three different camps…." (Male respondent, personal interview, 2015). This finding is in line with that of others and shows that social assets, as well as physical assets, gets destroyed by climate factors (floods).

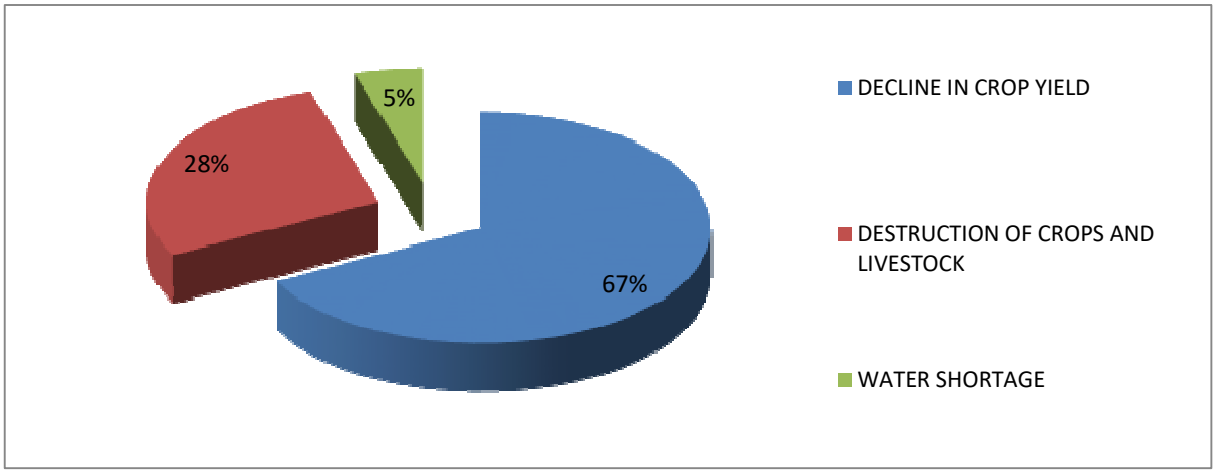


Figure 4: Effects of Droughts on Household

Source: Field Survey, 2015

As shown in Figure 4, majority (67%) of the respondents attributed the effects of drought to decline of crops yield whereas 28% and 5% of the remaining respondents attributed the effects of drought to destruction of

livestock and water shortage respectively. Whenever there is a decline in agricultural productivity, it brings additional effects on the household, thus affecting a household quality of life (Davis et al., 2007).

4.3 Coping dynamics for floods and drought

Floods are one of the common climatic shocks in the Northern part of Ghana and the country as a whole. Adapting a coping strategy required either non-monetary resources or monetary resources (Snel and Staring, 2001).

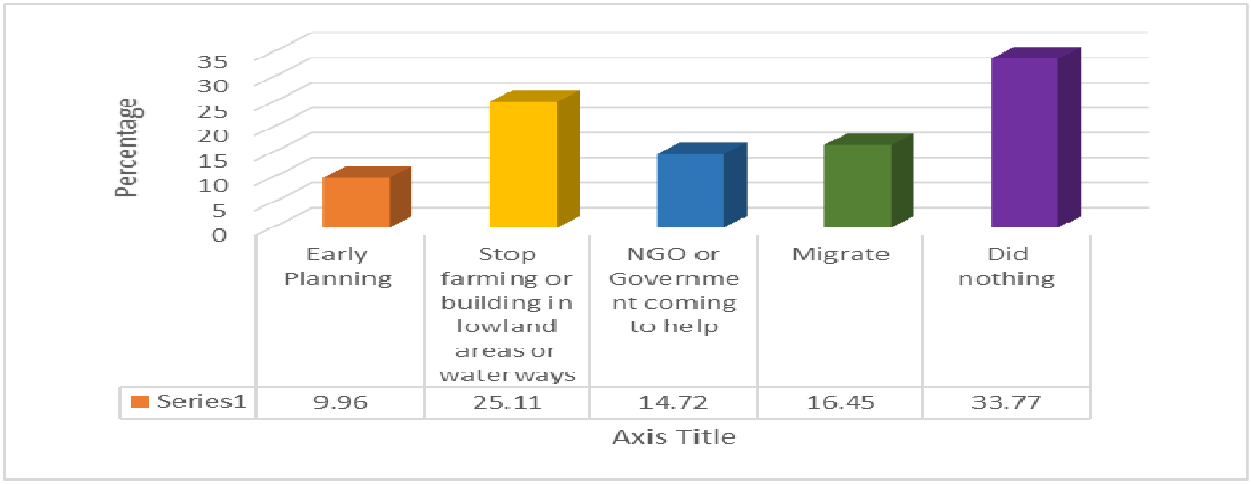


Figure 5: Main coping mechanisms for flood events

Source: Field Survey, 2015, n=231

As shown from Figure 5, majority (34%) of the sampled households adapted no mitigation measures (did nothing) to cope with the recent floods whiles 25% of the remaining households stop farming or building in lowlands areas or waterways as a coping strategy to the recent floods. Again, 16% and 15% of the households decides to migrate from the affected area to another area and others relied on external support from NGOs or government as a form of coping strategy respectively. The remaining 10% (minority) of the households adopt early planning as a strategy. These findings are in line with Nti (2012) who also indicated that majority of rural people did nothing in response to natural shocks, hence making them more vulnerable to similar disaster.

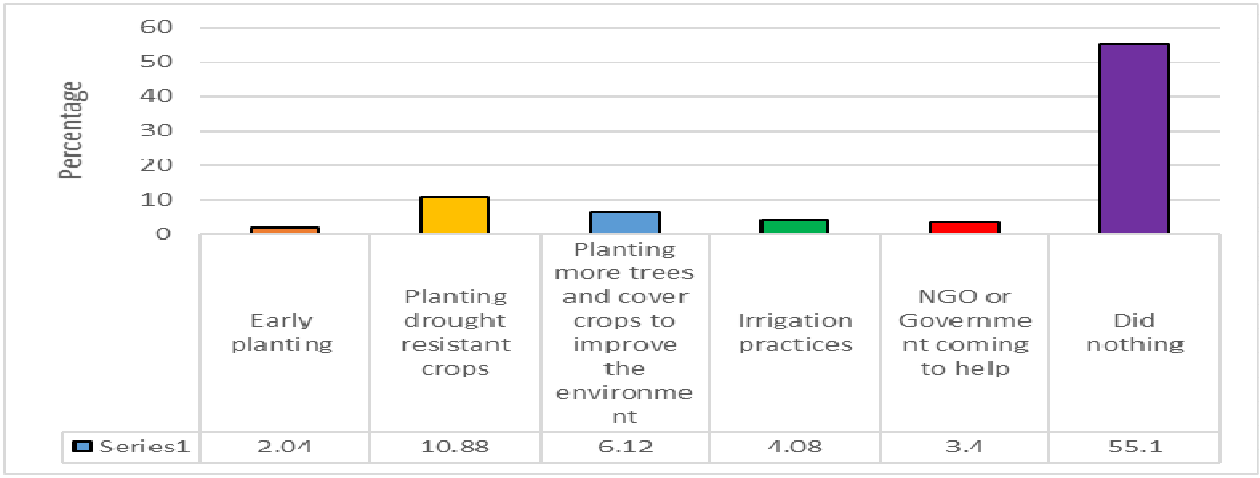


Figure 6: Main coping mechanisms for drought

Source: Field Survey, 2015, n=147

In addition, droughts are another major natural shock that affect the livelihood activities of the rural households in the study area and they are attributed to the advancing of the desert southwards every year (Dururugu, 2010).

The study found out that majority (55%) of the sampled households adapted no mitigation measures (did nothing) in response to the recent drought as with the flooding situation (Figure 6). This notwithstanding, 18% of the households decides to do dry season farming whiles 11% plant drought-resistant crops as a coping strategy to the recent drought. Again, 6% plant more trees and cover crops in response to drought whilst a minority of 2% households adopted early planting as a coping strategy against drought (See Figure 6). This finding once again is in line with Nti (2012) that rural folks did nothing in response to drought. According to Laurence and Williamson (2001), vegetative cover that is needed to serve as livestock feed and fuelwood will be lost as a result of drought and continued deforestation.

5. Conclusion

This study assessed the climatic effects of flood and drought on households in Northern Ghana and the current coping strategies adopted by the households. Destruction of food crops and livestock, decline in crop yield and food shortage as well as destruction of building were identified by the study as the most devastating effects of floods and droughts in the study areas. To cope with these effects, households adopted various coping dynamics which included decision not to farm or build in lowlands areas or waterways, migration, reliance on external support and early planning of activities. The study concludes that the effects of both floods and drought in Northern Ghana poses great challenges to livelihoods of households who have adapted by find coping strategies. The findings reveal new dimensions of the empirical accounts on households' coping dynamics in response the climatic effects of flood and drought.

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